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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/815,560	03/31/2004	Panya Wongsenakhum	NOVLP096/NVLS-2902	7130

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EXAMINER

ESTRADA, MICHELLE

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 09/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/815,560	Applicant(s) WONGSENAKHUM ET AL.	
	Examiner Michelle Estrada	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 July 2006.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 23-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 23-33 is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>7/17/06</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 rejected under 35 U.S.C. 103(a) as being unpatentable over Fang et al. (2003/0104126) in view of Kori et al. (6,551,929).

Fang et al. disclose: (a) positioning the substrate in the reaction chamber; (b) exposing the substrate to a boron-containing species to form a boron-containing layer ([0020] and [0023]); (c) contacting the boron-containing layer with a tungsten-containing precursor to form a tungsten nucleation layer ([0026]); (d) depositing a bulk tungsten layer over the tungsten nucleation layer to form the tungsten film ([0057]); and further comprising repeating (b) and (c) prior to (d) (See [0023] and [0026]).

Fang et al. do not disclose wherein at least one of the boron-containing species and the tungsten containing precursor reactants is provided to the reaction chamber by stabilizing a flow of the reactant by diverting the flow to an exhaust port without passing through the reaction chamber; and then pressurizing a gas line leading to the reaction chamber by flowing the reactant to the gas line prior to allowing the reactant to enter the reaction chamber.

The Examiner takes judicial notice that is well known in the art at the time of the invention to provide at least one of the boron-containing species and the tungsten containing precursor reactants to the reaction chamber by stabilizing a flow of the reactant by diverting the flow to an exhaust port without passing through the reaction chamber; and then pressurizing a gas line leading to the reaction chamber by flowing the reactant to the gas line prior to allowing the reactant to enter the reaction chamber. It would have been within the scope of one of ordinary skill in the art to apply this process to allow the reactant to enter the reaction chamber.

Re claim 2, it is well known in the art at the time of the invention that reaction chamber could have multiple stations.

Re claims 3-6, 14, One of ordinary skill in the art would have been led to the recited sheet resistance and thickness through routine experimentation to achieve a desired device dimension, device associated characteristics and device density on the finished wafer. In addition, the selection of the tungsten thickness and the boron-containing layer thickness, its obvious because it is a matter of determining optimum process conditions by routine experimentation with a limited number of species of result effective variables. These claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996)(claimed ranges or a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of

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the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill or art) and *In re Aller*, 105 USPQ 233 (CCPA 1995) (selection of optimum ranges within prior art general conditions is obvious).

Note that the specification contains no disclosure of either the critical nature of the claimed sheet resistance and tungsten thickness or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen sheet resistance and tungsten thickness or upon another variable recited in a claim, the Applicant must show that the chosen sheet resistance and tungsten thickness are critical. *In re Woodruf*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Note that Kobayashi et al. disclose forming a boron-containing layer of 200 nm, which is equal to 20 Å. This thickness is close to the one recited in claim 40, therefore this is a proof that the thickness of the boron-containing layer is a result effective variable.

Re claim 7, Fang et al. do not disclose after (b) and before (c), and after (c) and before (d), purging the reaction chamber.

Kori et al. disclose further comprising after (b) and before (c), and after (c) and before (d), purging the reaction chamber (See fig. 13).

It would have been within the scope of one of ordinary skill in the art to combine the teachings of Fang et al. and Kori et al. to enable the purging step of Kori et al. to be performed in the process of Fang et al. in order to exhaust the gases properly.

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Re claim 8, Kori et al. disclose wherein purging the reaction chamber comprises flowing carrier gas through the reaction chamber (Col. 5, lines 30-35).

Re claim 9, Kori et al. disclose wherein the carrier gas comprises nitrogen (Col. 5, lines 30-35).

Re claim 10, Kori et al. disclose wherein the substrate temperature during (b) and (c) is between 250 °C and about 450 °C (Col. 6, lines 15-17), which is within the range recited of claim 10 (200-475 °C).

Re claim 11, Kori et al. disclose wherein the reaction chamber pressure during (b) and (c) is between 1 Torr and about 10 Torr (Col. 6, line 32), which is within the range recited of claim 11 (1-350 Torr).

Re claim 12, Kori et al. disclose where the boron-containing species is a borane (Col. 8, lines 33-34).

Re claim 13, Kori et al. disclose wherein the borane is diborane (B_2H_6) (Col. 8, lines 33-34).

Re claim 15, Kori et al. disclose wherein the tungsten-containing precursor is WF_6 (Col. 5, line 25).

Re claim 16, Kori et al. disclose wherein (c) occurs for a time period sufficient to consume substantially all of the boron in the boron-containing layer (Col. 5, lines 35-50).

Re claim 17, Kori et al. disclose wherein the boron-containing species flow is stabilized.

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Re claim 18, Kori et al. disclose wherein the boron-containing species is delivered to the reaction chamber in (b) in a dilution gas comprising nitrogen (Col. 5, lines 20-30 and Col. 6, lines 55-60).

Re claim 19, Kori et al. disclose wherein the tungsten-containing presursor flow is stabilized.

Re claim 20, Re claim 18, Kori et al. disclose wherein the tungsten-containing presursor is delivered to the reaction chamber in (b) in a dilution gas comprising argon (Col. 5, lines 20-30).

Re claim 21, Kori et al. disclose wherein (d) involves using a CVD process (Col. 6, lines 41-43).

Allowable Subject Matter

Claims 23-33 are allowed.

The following is an examiner's statement of reasons for allowance: there is no disclosure in the prior art of the sequence of steps recited in claim 23.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michelle Estrada whose telephone number is 571-272-1858. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on 571-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 571-272-2800.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Michelle Estrada
Primary Examiner
Art Unit 2823

ME
September 20, 2006